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<td></td>
</tr>
</tbody>
</table>
# Problem Solving Words

<table>
<thead>
<tr>
<th>Addition</th>
<th>Subtraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ Sum</td>
<td>~ Difference</td>
</tr>
<tr>
<td>~ Increased</td>
<td>~ Decreased</td>
</tr>
<tr>
<td>~ Add</td>
<td>~ Less</td>
</tr>
<tr>
<td>~ Total</td>
<td>~ Subtract</td>
</tr>
<tr>
<td>~ Plus</td>
<td>~ Minus</td>
</tr>
<tr>
<td>~ More Than</td>
<td>~ How many more?</td>
</tr>
<tr>
<td>~ Greater Than</td>
<td>~ Subtracted from</td>
</tr>
<tr>
<td></td>
<td>~ Less than</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multiplication</th>
<th>Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ Product</td>
<td>~ Quotient</td>
</tr>
<tr>
<td>~ Twice (multiply by two)</td>
<td>~ Shared</td>
</tr>
<tr>
<td>~ Times</td>
<td>~ Divided by</td>
</tr>
<tr>
<td>~ Triple (multiply by three)</td>
<td>~ Divide</td>
</tr>
<tr>
<td>~ Multiply</td>
<td>~ Equal Parts</td>
</tr>
<tr>
<td>~ Doubled (multiply by two)</td>
<td>~ Into</td>
</tr>
<tr>
<td>~ Of</td>
<td></td>
</tr>
</tbody>
</table>
Common Math Symbols

= is equal to  
≠ is NOT equal to  
> is greater than  
< is less than  
≥ is greater than or equal to  
≤ is less than or equal to  
+ add, plus, sum  
- subtract, minus, difference  
× multiply, times, product  
÷ divide, quotient  
≈ is approximately equal to  
π Pi, 3.14, \( \frac{22}{7} \)
Ways to Show Multiplication

Multiplication sign: \(4 \times 2 = 8\)

Multiplication dot: \(4 \cdot 2 = 8\)

One set of parentheses: \(4(2) = 8\)

Two sets of parentheses: \((4)(2) = 8\)

A number next to a letter: \(4a\) means 4 times \(a\)

Two letters next to each other: \(ab\) means \(a\) times \(b\)
Ways to Show Division

Division sign: \[8 \div 2 = 4\]

Fraction bar: \[\frac{8}{2} = 4 \quad \frac{28.00}{5} = 0\]

** NOTE**

\textbf{Dividing by zero is undefined and is NOT permitted.} \[12 \div 0\]

\textbf{Zero divided by any number is zero.} \[0 \div 5 = 0\]
Symbols of Grouping

There are four main types of symbols for grouping:

- Parentheses ( )  
  Ex. (4 + 3)

- Brackets [ ]  
  Ex. [ 2 + 3(2)]

- Braces { }  
  Ex. { 3 + 4 - 3(2)}

- Fraction Bar ————  
  Ex. $\frac{4+6}{2}$

*** Always start with the inner-most group first
Math Vocabulary

**Addend** – numbers being added
**SUM** – result of an ADDITION problem

\[ \text{addend} + \text{addend} = \text{sum} \]

**Subtrahend** – number taken away from the **minuend**
**DIFFERENCE** – the result of a SUBTRACTION problem

\[ \text{minuend} - \text{subtrahend} = \text{difference} \]

**Factor** – number being multiplied
**PRODUCT** – result of a MULTIPLICATION problem

\[ \text{factor} \times \text{factor} = \text{product} \]

**Dividend** is divided by the **divisor**.
**QUOTIENT** – the result of a DIVISION problem

\[ \text{dividend} \div \text{divisor} = \text{quotient} \]
Number Families

**Counting Numbers (Natural Numbers)** – starts with one and includes the numbers we use to count
{1, 2, 3, 4, 5, …}

**Whole Numbers** - the counting numbers plus zero
{0, 1, 2, 3, 4, …}

**Integers** – whole numbers and their opposites
{…, -4, -3, -2, -1, 0, 1, 2, 3, 4, …}

**Rational Numbers** – numbers that can be written as a ratio of two integers
½ 5/3 -3/2 -4/1 0/2

**Irrational Numbers** - numbers that cannot be written as a ratio of two integers – the decimal answers - don’t end – don’t repeat
√3 π
Properties of Numbers

Commutative Property of… “Change Order”
- Changing the order of the values does not change the answer
  Addition: \(2 + 3 = 3 + 2\)
  Multiplication: \(4 \cdot 5 = 5 \cdot 4\)

Associative Property of… “Regroup”
- Changing the grouping of the values does not change the answer
  Addition: \((13 + 25) + 15 = 13 + (25 + 15)\)
  Multiplication: \((8 \cdot 15) \cdot 2 = 8 \cdot (15 \cdot 2)\)

Identity Property of… “Stays the Same”
- The SUM of any number and zero is that number
  Addition: \(12 + 0 = 12\)
- The PRODUCT of any number and one is that number
  Multiplication: \(6 \cdot 1 = 6\)
Properties of Numbers Continued

Zero Property of Multiplication… “Answer ALWAYS zero”
- When you multiply a number times zero the answer will always be zero
  
  Example: \[ 8 \times 0 = 0 \]
  \[ a \times 0 = 0 \]

Inverse Property of Multiplication… “Answer ALWAYS one”
- When you multiply a number by the reciprocal is ALWAYS equal to 1
  
  Example: \[ \frac{1}{3} \times \frac{3}{1} = 1 \]
Distributive Property

- Multiply everything (each term) inside of the parentheses by the number on the outside

\[ 6 \cdot 53 \]
\[ 6(50 + 3) \]

\[ 5(90 + 3) \quad 2(40 + 6) \quad 5(20 - 4) \quad 3(3x + 5) \]
Solving Equations

**INVERSE**
Do the OPPOSITE operation to both sides of the equation

Ex. \( x + 6 = 15 \) \( x - 15 = 5 \) \( x - 19 = 6 \)

\[ 3x = 15 \quad \frac{x}{4} = 5 \quad 5x = 50 \]

**SPECIAL CASES**
- Do the actual operation
  - **SUBTRAHEND MISSING**
  - **DIVISOR MISSING**

Examples: \( 30 - x = 12 \) \( 40 \div x = 8 \)
Coordinate Plane

Ordered Pair
(x, y)

Quadrants
I, II, III, IV
Tell location

If point is located on an axis – no quadrant – it is named by the axis
Naming Lines, Segments, Rays

**POINT:** indicates an exact location

**LINE:** never ending series of points
- zero endpoints
- named by 2 points it passes through
- written using symbols as: $\overrightarrow{AB}$ or $\overrightarrow{BA}$ or $m$

**LINE SEGMENT** (or just **SEGMENT**):
- part of a line
- two endpoints
- named by naming the 2 endpoints
- written using symbols as: $AB$ or $BA$ *$mAB$ “measure of”

**RAY:** never ending series of points going in only one direction
- one endpoint
- named by naming the endpoint then a point it passes through
- written using symbols as: $\overrightarrow{AB}$
Types of Lines

**PARALLEL LINES:** lines that will never touch

**PERPENDICULAR LINES:** lines that intersect to form 4 right angles

**INTERSECTING LINES:** OBLIQUE
Lines that cross and that do not form right angles

**HORIZONTAL** - “horizon”

**VERTICAL** - “vertical jump”
Types of Angles/Naming Angles

**ANGLE**: union of two rays with a common endpoint

*if it is named using 3 points, the vertex has to be the middle letter

∠ XYZ or ∠ ZYX

*if it is named using 1 point, it has to be the vertex

∠ Y

*it can be named by a number if there is a # inside the angle

∠ 3

**4 TYPES OF ANGLES:**

1) Acute (< 90°)

2) Right (= 90°)

3) Obtuse (> 90°)

4) Straight (= 180°)
Angle Relationships

**Complementary Angles:** two angles that have a sum of $90^\circ$

$m \angle 1 + m \angle 2 = 90^\circ$

**Supplementary Angles:** two angles that have a sum of $180^\circ$

$m \angle 3 + m \angle 4 = 180^\circ$

**Vertical Angles:** angles that are across from each other when two lines intersect. These angles are congruent ($\cong$). They are also known as opposite angles.

$\angle 1 \ & \angle 3 \quad \angle 2 \ & \angle 4$
**Angle Relationships Continued**

*Line t – transversal* — line intersecting a set of parallel lines

**CORRESPONDING ANGLES:**
* same side of the transversal
* same location on the parallel lines
* are congruent

\[ \angle 1 \ & \ \angle 5 \ \ \ \angle 2 \ & \ \angle 6 \ \ \ \angle 3 \ & \ \angle 7 \ \ \ \angle 4 \ & \ \angle 8 \]

**ALTERNATE INTERIOR ANGLES:**
* opposite sides of the transversal
* in between parallel lines
* are congruent

\[ \angle 3 \ & \ \angle 6 \ \ \ \angle 4 \ & \ \angle 5 \]

**ALTERNATE EXTERIOR ANGLES:**
* opposite sides of transversal
* outside of parallel lines
* are congruent

\[ \angle 7 \ & \ \angle 2 \ \ \ \angle 8 \ & \ \angle 1 \]
### Polygons

**Polygon** - a closed figure whose sides are line segments.  
**Regular polygon** - all sides congruent same

Polygons get their names based on the number of sides that they have.

<table>
<thead>
<tr>
<th>Name</th>
<th>Triangle</th>
<th>Quadrilateral</th>
<th>Pentagon</th>
<th>Hexagon</th>
</tr>
</thead>
<tbody>
<tr>
<td># of sides/angles</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>180°</td>
<td>360°</td>
<td>540°</td>
<td>720°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Heptagon</th>
<th>Octagon</th>
<th>Nonagon</th>
<th>Decagon</th>
</tr>
</thead>
<tbody>
<tr>
<td># of sides</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

**Similar Polygons** – have the same shape but not the same size

**Congruent Polygons** - have the same shape AND size
## Naming Triangles

Triangles are classified two different ways:  
1) **Angle size**  
2) **Length of sides**

### Named by angle size

<table>
<thead>
<tr>
<th></th>
<th>Acute</th>
<th>Right</th>
<th>Obtuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Diagram]</td>
<td>3 acute angles</td>
<td>1 right angle</td>
<td>1 obtuse angle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 acute angles</td>
<td>2 acute angles</td>
</tr>
</tbody>
</table>

Sum of all $\angle$'s in a triangle = $180^\circ$

### Named by length of side

<table>
<thead>
<tr>
<th></th>
<th>Scalene</th>
<th>Isosceles</th>
<th>Equilateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Diagram]</td>
<td>no congruent sides</td>
<td>2 congruent sides</td>
<td>3 congruent sides</td>
</tr>
<tr>
<td></td>
<td>no congruent angles</td>
<td>2 congruent angles</td>
<td>3 congruent angles</td>
</tr>
</tbody>
</table>
Pythagorean Theorem

Allows you to find missing sides of a right triangle

\[ a^2 + b^2 = c^2 \]

\( a^2 \)

\( b^2 \)

\( c^2 \)

Hypotenuse

legs

6 cm

8 cm

12 ft

13 ft
Square and Square Root

Reading Exponents

$4^2$ is either “four squared” or “four to the second power”

$(\frac{1}{2})^2$ is “one-half” to the fifth power

Square – the product of a number and itself

\[
5^2 = 5 \cdot 5 = 25 \quad 8^2 = 8 \cdot 8 = 64 \quad (0.6)^2 = 0.6 \cdot 0.6 = 0.36
\]

Perfect Square – the product when a whole number is multiplied by itself

\[
4^2 = 16 \quad 2^2 = 4 \quad 8^2 = 64
\]

Square Root – one of two equal factors of a number

\[
7^2 = 49 \quad 10^2 = 100 \quad 6^2 = 36
\]
\[
\sqrt{49} = 7 \quad \sqrt{100} = 10 \quad \sqrt{36} = 6
\]
**Order of Operations**

<table>
<thead>
<tr>
<th>Please</th>
<th>Parentheses</th>
<th>Ex. $30 - 2(3 + 1) + 2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excuse</td>
<td>Exponents</td>
<td></td>
</tr>
<tr>
<td>My</td>
<td>Multiplication</td>
<td>From left to right whichever comes first</td>
</tr>
<tr>
<td>Dear</td>
<td>Division</td>
<td></td>
</tr>
<tr>
<td>Aunt</td>
<td>Addition</td>
<td></td>
</tr>
<tr>
<td>Sally</td>
<td>Subtraction</td>
<td></td>
</tr>
</tbody>
</table>

$5 + 2(13 - 6) + 2$  \hspace{1cm} $15 \div 3 + 4 - 2 \cdot 3$
Estimation

- **Place Value (Rounding)** – round numbers to the same place value and solve
  \[19.65 + 9.83 = 20 + 10 = 30\]

- **Front-End** - 1) add whole numbers 2) estimate (group) decimals 3) put together
  
  \[
  \begin{array}{c}
  5.2 \\
  4.83 \quad \text{about 1} \\
  + \quad 1.01 \quad \text{about 0} \\
  10
  \end{array}
  \]

- **Clustering** – works for numbers that are all about the same
  
  \[9.8 + 9.32 + 8.5 + 8.9 \quad \text{all about 9} \]
  
  \[9 \cdot 4 = 36\]

- **Compatible Numbers** – works best for division – use numbers that work well together
  
  **Start with the 2\textsuperscript{nd} number**
  
  \[19.5 \div 7.2\]
### Decimals- Place Value

<table>
<thead>
<tr>
<th></th>
<th>Tenths</th>
<th>Hundredths</th>
<th>Thousandths</th>
<th>Ten thousandths</th>
<th>Hundred thousandths</th>
<th>Millionths</th>
<th>Ten millionths</th>
</tr>
</thead>
</table>

- **Reading Decimals**: replace the decimal point with the word **and**, then read the decimal as if it is a whole number along with the place value of the position farthest to the right.

  Ex. 4.325 is read “four **and** three hundred twenty-five thousandths”

- **Terminating Decimals**: decimals that stop like .3

- **Repeating Decimals**: decimals that repeat and are noted with a bar over the repeating number(s). Ex. .1414 … is noted as .14
Comparing and Ordering Decimals

- To make comparison easier, align the decimals, then fill in zeroes as needed. Compare numbers one place value at a time.

Example: Compare .5476 and .55

```
.5476
.5500
```

Compare starting with the decimal point, since the fives in the tenths place are the same you compare the next digit. Since 5 is greater than 4 the bottom decimal is bigger.
Adding/Subtracting Decimals

- Line up the decimals
- Add zeroes to fill empty positions
- Add or subtract
- Bring the decimal straight down to your answer

*** Remember *** the imaginary decimal is located at the END of any whole number

Addition Example: 3.5 + .024 + 6.73

\[
\begin{align*}
3.5 \\
.024 \\
+ 6.73
\end{align*}
\]

Subtraction Example: 13.7 – 11.511

\[
\begin{align*}
13.7 \\
- 11.511
\end{align*}
\]
## Power of Ten

10, 100, 1000, 10000 …

<table>
<thead>
<tr>
<th><strong>Multiplying</strong></th>
<th><strong>Dividing</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Count the number of zeroes</td>
<td>- Count the number of zeroes</td>
</tr>
<tr>
<td>- Move the decimal that many spaces to the RIGHT</td>
<td>- Move the decimal that many spaces to the LEFT</td>
</tr>
</tbody>
</table>

Examples:

<table>
<thead>
<tr>
<th>Example</th>
<th>Example</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>46.2 ÷ 100</td>
<td>0.9 • 1,000</td>
<td>3 ÷ 10</td>
</tr>
</tbody>
</table>
Multiplying Decimals

- Ignore decimals, line numbers up on the right side
- Multiply
- Count the number of digits to the right of the decimal point in the problem
- Move over that same number of decimal places in the answer

Example: 2.25 x 55.5

\[
\begin{array}{c}
2.25 \\
x \quad 55.5
\end{array}
\]

2 digits
1 digit
Dividing Decimals

*** Top or first number must go inside of the house

- Move the decimal on the outside to the end of the number
- Move the decimal on the inside the same number of spaces
- Take the decimal straight up to the answer
- Divide

*** Remember that any number has an imaginary decimal point after the ones digit

Example:  \[\frac{5.852}{1.1}\] \[0.416 \div 0.05\] \[15 \div 4\]
**Integers/Absolute Value**

*Integer* - positive or negative whole number, **including zero**

![Number Line]

**Absolute Value** – the distance away from zero, always positive

Ex. $|-5| = 5$  $|3| = 3$

**Showing Problems on a Number Line** - $3 - 8$

![Number Line]
# Adding Integers

**Follow the following rules:**

<table>
<thead>
<tr>
<th>Same Sign</th>
<th>Different Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADD</td>
<td>SUBTRACT</td>
</tr>
<tr>
<td>Use the sign of the numbers</td>
<td>Use the sign of the &quot;larger&quot; number</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Example</th>
<th>Example</th>
<th>Example</th>
<th>Example</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>-6 + 8</td>
<td>-3 + (-3)</td>
<td>-9 + 5</td>
<td>-6 + (-18)</td>
<td>-10 + 3</td>
</tr>
</tbody>
</table>
### Subtracting Integers

- Change ALL subtraction to addition (**Leave, Change, Change**)
- Follow rules for addition

<table>
<thead>
<tr>
<th>Same Sign</th>
<th>Different Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADD</td>
<td>SUBTRACT</td>
</tr>
<tr>
<td>Use the sign of the numbers</td>
<td>big - small</td>
</tr>
</tbody>
</table>

-6 – (-5) -3 – 6  5 – (-9)  -9 – (-7)
Multiplying/Dividing Integers

- Decide positive or negative

  Two negatives make a positive
  \[(+)(+) \quad (-)(+)
  \]

  One negative makes the whole thing negative
  \[(-)(-) \quad (+)(-)
  \]

- Multiply/Divide

  \[9 \cdot (-6) \quad ( -3) \cdot (-5) \quad \frac{-9}{-3} \quad 48 \div (-8)
  \]
**Exponents**

**BASE**: a number being multiplied

**EXPONENT**: tells how many times the base is used as a factor

\[4^3 = 4 \cdot 4 \cdot 4 = 64\]

\[5^3 = \quad 4^2 = \quad 2^5 = \]

\[12 + 3^3 - 2 \cdot 5\]
**Scientific Notation**

A number in **SCIENTIFIC NOTATION** is written as the product of a number between 1 and 10 and a power of ten.

\[
\begin{array}{c}
\text{number } \geq 1 \\
\text{but } < 10 \\
\text{** Only ONE digit} \\
\text{may be in front of the decimal}
\end{array}
\quad \times 10^{\text{This exponent tells how many times the decimal was moved.}}
\]

Examples:

<table>
<thead>
<tr>
<th>Put into scientific notation</th>
<th>Write in standard form</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,088,000</td>
<td>8.65 \times 10^7</td>
</tr>
<tr>
<td>76,200</td>
<td>9.1 \times 10^4</td>
</tr>
</tbody>
</table>
The three basic metric units:

1) **meters**: distance or length (m)
2) **liters**: capacity (L)
3) **grams**: mass (g)

<table>
<thead>
<tr>
<th>Length</th>
<th>kilo-</th>
<th>hecto-</th>
<th>deka-</th>
<th>UNIT</th>
<th>deci-</th>
<th>centi-</th>
<th>milli-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kilometer (km)</td>
<td>Hectometer (hm)</td>
<td>Dekameter (dam)</td>
<td>Meter (m)</td>
<td>Decimeter (dm)</td>
<td>Centimeter (cm)</td>
<td>Millimeter (mm)</td>
</tr>
<tr>
<td>Capacity</td>
<td>Kiloliter (kL)</td>
<td>Hectoliter (hL)</td>
<td>Dekaliter (daL)</td>
<td>Liter (L)</td>
<td>Deciliter (dL)</td>
<td>Centiliter (cL)</td>
<td>Milliliter (mL)</td>
</tr>
<tr>
<td>Mass</td>
<td>Kilogram (kg)</td>
<td>Hectogram (hg)</td>
<td>Dekagram (dag)</td>
<td>Gram (g)</td>
<td>Decigram (dg)</td>
<td>Centigram (cg)</td>
<td>Milligram (mg)</td>
</tr>
</tbody>
</table>
# Divisibility Rules

<table>
<thead>
<tr>
<th>#</th>
<th>A number is divisible by ____ if the ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>last digit is even</td>
</tr>
<tr>
<td>3</td>
<td>sum of the digits is divisible by 3</td>
</tr>
<tr>
<td>4</td>
<td>last two digits are divisible by 4</td>
</tr>
<tr>
<td>5</td>
<td>last digit is 0 or 5</td>
</tr>
<tr>
<td>6</td>
<td>number is divisible by both 2 &amp; 3</td>
</tr>
<tr>
<td>8</td>
<td>last three digits are divisible by 8</td>
</tr>
<tr>
<td>9</td>
<td>sum of the digits is divisible by 9</td>
</tr>
<tr>
<td>10</td>
<td>last digit is 0</td>
</tr>
</tbody>
</table>

**243:**

**1,024:**
Factors/Multiples

- **Factors:** numbers which, when multiplied together, give a product
  * divisors of that number
  Example:
  
  \[
  \begin{align*}
  1 \times 6 &= 6 \\
  2 \times 3 &= 6 \\
  \end{align*}
  \]
  therefore; 1, 2, 3, and 6 are factors of 6

- **Multiples:** the answer when you multiply a number times any other number
  Ex. Multiples of 3: 3, 6, 9, 12, 15 …

- **Prime Numbers:** a number that has exactly two factors, 1 and itself
  Ex. 2, 3, 5, 7, 11 …

- **Composite Numbers:** any number having more than two factors
  Ex. 4, 6, 10, 12, 15 …
  *0 and 1 are neither prime nor composite

Example: List the prime numbers between 20 and 30

\[
\begin{align*}
20 & \quad 21 & \quad 22 & \quad 23 & \quad 24 & \quad 25 & \quad 26 & \quad 27 & \quad 28 & \quad 29 & \quad 30
\end{align*}
\]
Prime Factorization

- Writing the number as a product of prime numbers

<table>
<thead>
<tr>
<th>Tree</th>
<th>Ladder</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>
GCF/LCM

- **GCF:** (Greatest Common Factor) is the largest factor common to two numbers
  - *Largest number they can be divided by*
    *List factor pairs of both numbers. Find the biggest one they have in common*
    *See if the smaller number goes into the bigger one.*
    *Ask yourself – What else can I divide the smaller number by?*
    
    24, 18

- **LCM:** (Lowest Common Multiple) is the smallest multiple common to two numbers
  *List the multiples of each number, find the first one that they have in common.*
  *Multiply the numbers together.*

   16, 6
Equivalent Fractions

Simplifying Fractions
1) Find the GCF (greatest common factor) of the numerator and denominator
   **What is the biggest number that you can divide both by?**
2) Divide BOTH the numerator and denominator by that number

\[
\begin{array}{cccc}
24 & 12 & 35 & 10 \\
36 & 15 & 45 & 14 \\
\end{array}
\]

Finding a Common Denominator
1) Find the LCM (lowest common multiple) of the numbers
2) Multiply both the numerator and denominator by the SAME number to “get to” the new denominator

\[
\begin{array}{ccc}
4 & 7 & 1 \\
5 & 8 & 6 \\
\end{array}
\]

Ex.
\[
\begin{array}{ccc}
2 & 5 & 4 \\
3 & 6 & 9 \\
\end{array}
\]
**Improper --- Mixed**

Improper Fraction – numerator is bigger than the denominator
Mixed Number – a whole number and a fraction

**Improper Fraction to Mixed Numbers**
1) Do TOP divided by BOTTOM
2) Find the whole number, what is left over is the numerator, denominator stays the same

\[
\frac{25}{6} \div \frac{4}{6)25} = \frac{4}{6}
\]

**Mixed Number to Improper Fraction**

CHECKMARK
1) Multiply the whole number times the denominator
2) Add the numerator
3) Denominator stays the same

\[
3 \frac{1}{9} \times 3 \frac{1}{9} = \frac{28}{9} = 5
\]
Compare/Order Fractions

**CHOICES**

1) Find a common denominator \( \frac{3}{4} \) \( \square \) \( \frac{2}{3} \)

2) Cross multiply \( \frac{3}{4} \) \( \square \) \( \frac{2}{3} \)

3) Convert to decimal form \( \frac{3}{4} \) \( \square \) \( \frac{2}{3} \)

4) Use benchmark fractions (1/2) \( \frac{3}{10} \) \( \square \) \( \frac{7}{12} \)

5) Common numerator \( \frac{1}{6} \) \( \square \) \( \frac{1}{8} \)
Adding/Subtracting Fractions and Mixed Numbers

1) Line up VERTICALLY
2) Find a common denominator
3) Add/Subtract
4) Reduce/Simplify to final form

Ex.

\[1\frac{3}{5} + 2\frac{4}{7}\]

\[= \frac{8}{5} + \frac{18}{7}\]

\[= \frac{56 + 90}{35}\]

\[= \frac{146}{35}\]

\[\text{Reduce/Simplify to final form: } \frac{146}{35} = 4\frac{6}{35}\]

\[\frac{3}{3} - 1\frac{1}{4}\]

\[= \frac{2}{3} - \frac{5}{4}\]

\[= \frac{8 - 15}{12}\]

\[= -\frac{7}{12}\]

\[\text{Reduce/Simplify to final form: } -\frac{7}{12}\]
Subtracting Fractions with BORROWING

**Subtract from a WHOLE NUMBER**

\[
\begin{array}{c}
15 \\
-11 \frac{5}{6}
\end{array}
\]

**Rename whole number as a mixed number**
**Be sure to choose a fraction with a common denominator**

**Subtract with a FRACTION**

\[
\begin{array}{c}
13 \frac{1}{3} \\
- 5 \frac{5}{8}
\end{array}
\]

- Find a common denominator
- Borrow from the whole number
- **trick** – add the numerator and denominator together to get your new fraction.
Multiplying Fractions and Mixed Numbers

1) Change all mixed numbers to improper fractions
2) Check for the SHORTCUT
3) Multiply the numerators
4) Multiply the denominators
5) Simplify to final form

Ex. \[\frac{2}{3} \cdot \frac{5}{8}, \quad \frac{5}{7} \cdot \frac{21}{50}, \quad \frac{1\frac{1}{3}}{\frac{2\frac{1}{4}}{4}}\]
Dividing Fractions and Mixed Numbers

1) Change all mixed numbers to improper fractions
2) Rewrite the problem
   *** leave the 1st fraction the same
   *** change the division to multiplication
   *** flip the 2nd fraction upside down (reciprocal)
3) Check for the shortcut
4) Multiply the numerators
5) Multiply the denominators
6) Simplify to final form

Ex. \[ \frac{5}{7} \div \frac{1}{3} \quad \frac{1\frac{1}{2}}{2} \div \frac{3}{4} \quad 5 \div 1\frac{1}{6} \]
Ratios and Rates

Ratio – comparison of two different quantities
- 3 ways to write --- : to -----
  3:4  3 to 4  \( \frac{3}{4} \)
- Can reduce 15:10 = 3:2

Rate – type of ratio compares two quantities with different labels
Ex. 30 miles/1 gallon $2.99/3 oranges

Unit Rate – the rate for one unit of a given quantity *Use to compare different size pkgs.
*** divide btm top
Ex. 36 gallons for 8 containers

 \[ \frac{8}{36} \]
Proportions

**Proportion** – equation stating that two ratios are equal

Ex. \( \frac{6}{8} = \frac{9}{12} \)

**Testing for Proportionality** –
- Reducing
- Finding a common multiplier
- Cross products

**Solving Proportions** –
- Find a common multiplier
- Cross multiply and divide

Ex. \( \frac{12}{15} = \frac{x}{20} \)
Similar Figures

**Similar Figures** – figures that are the same shape, but not necessarily the same size
- Corresponding angles are the same
- Corresponding sides are proportional

![Diagram of similar triangles]

\[ \triangle ABC \cong \triangle DEF \]

**Verifying Figures are Similar/Finding a Missing Side** –
* be sure to line up corresponding sides

\[
\frac{\text{small}}{\text{big}} = \frac{9 \text{ m}}{12 \text{ m}}
\]

**Ex.**

<table>
<thead>
<tr>
<th>Small</th>
<th>Big</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 m</td>
<td>X</td>
</tr>
<tr>
<td>6 m</td>
<td>12 m</td>
</tr>
</tbody>
</table>

Ex. 9 m X 6 m 12 m
### Benchmark Percents

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Decimal</th>
<th>Percent</th>
<th>Calculation</th>
<th>Fraction</th>
<th>Decimal</th>
<th>Percent</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\frac{1}{2})</td>
<td>0.5</td>
<td>50%</td>
<td>(\frac{1}{2} = 0.5 = 50%)</td>
<td>(\frac{1}{3})</td>
<td>0.333</td>
<td>(33\frac{1}{3})%</td>
<td>(\frac{1}{3} = 0.3 = 33\frac{1}{3})%</td>
</tr>
<tr>
<td>(\frac{1}{4})</td>
<td>0.25</td>
<td>25%</td>
<td>(\frac{1}{4} = 0.25 = 25%)</td>
<td>(\frac{2}{3})</td>
<td>0.667</td>
<td>(66\frac{2}{3})%</td>
<td>(\frac{2}{3} = 0.6 = 66\frac{2}{3})%</td>
</tr>
<tr>
<td>(\frac{3}{4})</td>
<td>0.75</td>
<td>75%</td>
<td>(\frac{3}{4} = 0.75 = 75%)</td>
<td>(\frac{1}{5})</td>
<td>0.2</td>
<td>20%</td>
<td>(\frac{1}{5} = 0.2 = 20%)</td>
</tr>
<tr>
<td>(\frac{2}{10})</td>
<td>0.2</td>
<td>20%</td>
<td>(\frac{2}{10} = 0.2 = 20%)</td>
<td>(\frac{1}{8})</td>
<td>0.125</td>
<td>12.5%</td>
<td>(\frac{1}{8} = 0.125 = 12.5%)</td>
</tr>
<tr>
<td>(\frac{3}{10})</td>
<td>0.3</td>
<td>30%</td>
<td>(\frac{3}{10} = 0.3 = 30%)</td>
<td>(\frac{3}{8})</td>
<td>0.375</td>
<td>37.5%</td>
<td>(\frac{3}{8} = 0.375 = 37.5%)</td>
</tr>
<tr>
<td>(\frac{4}{10})</td>
<td>0.4</td>
<td>40%</td>
<td>(\frac{4}{10} = 0.4 = 40%)</td>
<td>(\frac{5}{8})</td>
<td>0.625</td>
<td>62.5%</td>
<td>(\frac{5}{8} = 0.625 = 62.5%)</td>
</tr>
<tr>
<td>(\frac{7}{8})</td>
<td>0.875</td>
<td>87.5%</td>
<td>(\frac{7}{8} = 0.875 = 87.5%)</td>
<td>(1 = 1.0 = 100%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pattern continues...
Fraction, Decimal, Percent

generate denominator to 100

\[
\frac{\text{bottom}}{\text{top}} = \frac{\text{numerator}}{100}
\]

move decimal 2 spaces RIGHT

move decimal 2 spaces LEFT

look at place value and reduce

put percent over 100 and reduce
Percents

**KNOW the percent and whole**

- Use benchmark fractions
- T-Chart
  - Find 10% (move the decimal one space left)
  - 1% (move the decimal two spaces left)
- Change percent to a decimal and multiply
  - Set up a proportion
    
    \[
    \frac{is}{of} = \frac{\%}{100}
    \]

**DON’T know PERCENT**

- Set up a fraction
  \[
  \frac{Part\ (is)}{Whole\ (of)}
  \]
- Try to get to 100
- Reduce
- Check for benchmark
Percent of Change

\[
\frac{\text{amount of change}}{\text{original amount}} = \frac{\% \text{ of change}}{100}
\]
Stem and Leaf Plot

Breaks data into a:
- stem (tens and/or hundreds digit)
- leaf (ones digit)

<table>
<thead>
<tr>
<th>stem</th>
<th>leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Example: \{22, 15, 7, 19, 15, 29, 26, 25, 8, 5, 3, 44, 45, 25, 46\}

Numbers should be in numerical order on the stem and the leaf.
Measures of Central Tendency

**Mean** –
1) Add up the data items
2) Divide by the number of data items
   - Best used when the data is numerical, with no outliers

**Median** –
1) Put the numbers in order from least to greatest
2) Find the middle number. **** If the median is in the middle of two numbers – add those numbers and divide by 2
   - Best used when data is numerical, with outliers

**Mode** –
- The data item that occurs most often
- There can be one mode, more than one mode, or no mode
  - Best used when data is not numerical

**Range** – difference between the smallest and the largest data items

**Outlier** – a data value that is much higher or lower than the other data values. An outlier can affect the mean of a group of data
Types of Graphs

**Bar Graph**
- Best used for categories of data

**Line Graph**
- Best used for data over a period of time
- Used to show trends in data

**Circle Graph**
- Best used to compare data involving percentages

**Histogram**
- Best used for intervals of data to show frequency

**Box and Whisker** – a graph that displays the median, quartiles, and extremes of a set of data
Simple Probability

PROBABILITY – the chance of a particular outcome occurring

Probability = \( P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{total number of possible outcomes}} \)

** can be expressed as a fraction, a decimal or a percent

SAMPLE SPACE – list of all possible outcomes

Ex. Coin #Cube
P(heads) P(5)

THEORETICAL PROBABILITY – what SHOULD occur
EXPERIMENTAL PROBABILITY – what DOES occur

\[
\begin{align*}
0 & \quad \frac{1}{2} & \quad 1
\end{align*}
\]
**Perimeter**

*Perimeter* – distance around the outside of a figure. Use regular label.

\[ P = \text{add all sides} \]
**Area**

**Area** – amount of space inside a figure. Use the label $^2$.

- **Rectangle** $A = lw$
- **Square** $A = s^2$ or $A = lw$
- **Parallelogram** $A = bh$
- **Triangle** $A = \frac{bh}{2}$
- **Trapezoid** $A = \frac{(b_1 + b_2)h}{2}$

<table>
<thead>
<tr>
<th>$A$ = area</th>
</tr>
</thead>
<tbody>
<tr>
<td>$l$ = length</td>
</tr>
<tr>
<td>$w$ = width</td>
</tr>
<tr>
<td>$b$ = base</td>
</tr>
<tr>
<td>$h$ = height</td>
</tr>
<tr>
<td>$s$ = side</td>
</tr>
</tbody>
</table>
Circles

Area – amount of space inside the circle
radius – distance half way across a circle

\[ A = \pi \cdot r^2 \]

Circumference – distance around the outside of a circle
diameter – distance all the way across a circle

\[ C = \pi \cdot d \]
**Polyhedron**

A general term that identifies a solid with faces that are polygons
Has no curved surfaces or edges

**Prism** - has parallel bases that are the same – named by the shape of the base

**Pyramid** – has a base and comes to a point – named by the shape of the base

**Cylinder** – has circle bases

**Cone** – has a circle base and comes to a point

**Sphere** – a smooth curved solid - looks like a ball
**Volume**

**Volume** = the measure of the space occupied by a solid

\[ V = Bh \]

“B” stands for the area of the base

“h” stands for the distance between the bases

Cylinder: \( V = \pi r^2 h \)

Rectangular prism: \( V = lwh \)

<table>
<thead>
<tr>
<th>V = volume</th>
<th>( \pi = 3.14 )</th>
<th>( r = radius )</th>
<th>( h = height )</th>
<th>( w = width )</th>
</tr>
</thead>
</table>

![Diagram showing a cube, a rectangular prism, and a cylinder with formulas and variables.]
# Customary Conversions

<table>
<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Capacity (volume)</th>
<th>Time</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td>Inch (in.)</td>
<td>Fluid ounce (fl oz)</td>
<td>Second (s)</td>
<td>Ounce (oz)</td>
</tr>
<tr>
<td></td>
<td>Foot (ft)</td>
<td>Cup (c)</td>
<td>Minute (min)</td>
<td>Pound (lb)</td>
</tr>
<tr>
<td></td>
<td>Yard (yd)</td>
<td>Pint (pt)</td>
<td>Hour (hr)</td>
<td>Ton (t)</td>
</tr>
<tr>
<td></td>
<td>Mile (mi)</td>
<td>Quart (qt)</td>
<td>Day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gallon (gal)</td>
<td>Week (wk)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Year</td>
<td></td>
</tr>
<tr>
<td>Equivalents</td>
<td>1 ft = 12 in</td>
<td>1 c = 8 fl oz</td>
<td>1 min = 60 s</td>
<td>1 lb = 16 oz</td>
</tr>
<tr>
<td></td>
<td>1 yd = 3 ft</td>
<td>1 pt = 2 c</td>
<td>1 hr = 60 min</td>
<td>1 t = 2,000 lb</td>
</tr>
<tr>
<td></td>
<td>1 mi = 5,280 ft</td>
<td>1 qt = 2 pt</td>
<td>1 day = 24 hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 mi = 1,760 yd</td>
<td>1 gal = 4 qt</td>
<td>1 year = 52 wk</td>
<td></td>
</tr>
</tbody>
</table>